WHAT IS CLAIMED IS:

1. A method for ablating a material, the method comprising the steps of:

a) directing a pulse of energy at the material so as to ablate a quantity of the material and so as to permanently modify a quantity of the material, the pulse being configured to increase a ratio of the quantity of the material which is ablated thereby with respect to the quantity of the material which is permanently modified thereby; and

b) wherein ablating the material with an energy pulse configured to increase the ratio of the quantity of the material which is ablated thereby with respect to the quantity of the material which is permanently modified thereby minimizes undesirable permanent modification of the material.

2. A method for ablating material with directed energy, the method comprising the steps of:

a) determining at least one characteristic of the material to be ablated;

b) defining a pulse of the directed energy which increases a ratio of a quantity of the material which will be ablated thereby with respect to a quantity of the material which will be permanently modified thereby, the characteristic(s) of the material determined in step (a) at least partially defining the pulse; and

c) ablating the material with at least one pulse of directed energy which is defined according to step (b);

d) wherein ablating the material with directed energy defined according to step (b) minimizes undesirable permanent modification of the material.

3. The method as recited in Claim 2, wherein the directed energy comprises laser radiation.

4. The method as recited in Claim 2 wherein the directed energy comprises light from at least one of an LED, a fluorescent lamp, and/or incandescent lamp.

5. The method as recited in Claim 2 where the directed energy comprises incandescent light.

6. The method as recited in Claim 2, wherein the step of determining at least one characteristic of the material being ablated comprises:

a) ablating the material with a pulse of the directed energy;

b) determining the approximate quantity of the material ablated; and

c) determining the approximate quantity of the material permanently modified.

7. The method as recited in Claim 2 wherein the characteristic(s) of the material determined comprise at least one of the thermal conductivity, effective electromagnetic energy penetration depth, material energy gap between valence and conduction bands, material density, material strength.

8. A method for ablating a material, the method comprising the steps of:

a) directing a plurality of pulses of energy at the material so as to ablate a quantity of the material and so as to permanently modify a quantity of the material, the pulses having a sufficient pulse rate as to increase a ratio of the quantity of the material which is ablated thereby with respect to the quantity of the material which is permanently modified thereby;

b) wherein ablating the material with a plurality of directed energy pulses having a sufficient pulse rate as to increase a ratio of the quantity of the material which is ablated thereby with respect to the quantity of material which is

permanently modified thereby minimizes undesirable permanent modification of the material.

9. A method for ablating material with directed energy, the method comprising the steps of:

a) determining at least one characteristic of the material to be ablated;

b) defining a pulse rate of the directed energy which increases a ratio of a quantity of the material which will be ablated thereby with respect to the quantity of the material which will be permanently modified thereby, the characteristic(s) of the material determined in step (a) at least partially defining the pulse rate; and

c) ablating the material with a plurality of directed energy pulses which are defined according to step (b);

d) wherein ablating the material with a plurality of directed energy pulses defined according to step (b) minimizes undesirable permanent modification of the material.

10. A method for ablating material with directed energy, the method comprising the steps of:

a) determining at least one characteristic of the material to be ablated;

b) defining both a pulse of the directed energy and a pulse rate of the directed energy, the combination of which increases a ratio of a quantity of the material which will be ablated thereby with respect to a quantity of the material which will be permanently modified thereby, the characteristic(s) of the material determined in step (a) at least partially defining the pulse; and

c) ablating the material with at least one pulse of directed energy which is defined according to step (b);

d) wherein ablating the material with directed energy defined according to step (b) minimizes undesirable permanent modification of the material.

11. A method for enhancing precision and volume of material removed per unit time via laser ablation while mitigating undesirable damage caused thereby, the method comprising the steps of:

a) ablating material using a laser, the laser being configured for use with the material so as to cause a substantial quantity of energy absorbed by the material to subsequently be removed therefrom with material ejected during ablation; and

b) wherein removing a substantial amount of the energy absorbed by the material minimizes residual energy deposition while ablating, so as to mitigate collateral thermal damage to the material.

12. The method as recited in Claim 11, wherein the step of ablating material comprises removing material at a rate greater than thermal energy diffusion rate through the material so as to remove residual energy from the material.

13. The method as recited in Claim 11, wherein the step of ablating material comprises ablating material using a laser having a sufficiently high pulse repetition rate to cause a substantial amount of energy absorbed by the material to subsequently be removed therefrom with ejected material.

14. The method as recited in Claim 11, wherein the step of ablating material comprises defining characteristics of a laser beam pulse based upon properties of the material so as to provide a depth of the material removed by the pulse which is approximately of the same order of magnitude as an electromagnetic energy deposition depth.

15. The method as recited in Claim 11, wherein the step of ablating material using a laser comprises defining

characteristics of a laser beam pulse based upon properties of the material so as to provide a plasma, the plasma being generated by at least one of multiphoton ionization and thermal ionization, the plasma effecting an electromagnetic energy deposition depth which is approximate to a depth of the material removed by the pulse.

16. The method as recited in Claim 11, further comprising the step of adding doping agents to the material being ablated, the doping agents causing the laser to provide an electromagnetic energy deposition depth which is approximately equal to a depth of the material removed by a laser pulse.

17. A method for a high precision, highly controllable, variable rate, material removal by a pulsed electromagnetic radiation beam, the interaction between the pulsed electromagnetic radiation beam and the material effecting a material removal depth approximately of the same order magnitude as the energy deposition depth within the material, the method comprising the steps of:

a) providing an electromagnetic radiation source capable of generating an output beam comprised of a sequence of electromagnetic pulses, each having a pulse duration in the range of approximately 1 femtosecond to approximately 10 milliseconds;

b) operating the source and manipulating the beam parameters so that the electromagnetic pulses' power densities within the region targeted for energy deposition is in the range of approximately 10^5 W/cm^3 to approximately 10^{18} W/cm^3 and is larger than the power density threshold for material ablation;

c) ablating the material with electromagnetic energy from the source so that a substantial portion of deposited electromagnetic energy is removed from the target material with an ejected portion of the material;

d) repeating the ablation of the material at a pulse repetition rate greater than 0.1 pulses per second so that a substantial portion of the cumulative residual thermal energy left in the material by the electromagnetic energy is removed by ablation, and at a pulse repetition rate smaller than about 1,000,000 pulses per second, until a desired depth of material has been removed.

18. The method of Claim 17, wherein the electromagnetic beam's energy deposition depth within the material defines a volume so that the power density within the volume is greater than the threshold power density for material ablation.

19. The method of Claim 18, wherein the pulsed electromagnetic radiation source produces an output beam having a wavelength in the range of approximately 10 nanometers to approximately 1,000 micrometers.

20. The method of Claim 19, wherein each pulse of the pulsed source has an energy in the range of approximately 0.001 microjoule to approximately 50 Joule, and the output beam has a diameter at the material target such that the target material experience an energy fluence in the range of approximately 0.0001 Joule per square centimeter to approximately 100 Joule per square centimeter.

21. The method of Claim 20, wherein the pulsed beam exhibits a material removal rate in the range of approximately 0.01 micrometers to approximately 100,000 micrometers per pulse, the removal rate being substantially constant.

22. A method for precise, highly controlled, variable rate material removal by a pulsed electromagnetic radiation beam, the interaction between the pulsed electromagnetic radiation beam and the material effecting the formation of plasma, the method comprising the steps of:

a) providing a source capable of generating an

output beam comprised of a sequence of electromagnetic pulses each having a pulse duration in the range of approximately 1 femtosecond to approximately 10 milliseconds;

b) operating the source and manipulating the beam parameters so that the electromagnetic pulses' power densities within the region targeted for energy deposition is in the range of approximately 10^6 W/cm^3 to approximately 10^{18} W/cm^3 and is larger than the power density threshold for plasma formation;

c) allowing the interaction to proceed such that a layer of the material is removed;

d) the removed layer of material carrying with it a substantial portion of the deposited electromagnetic energy from the target regions;

e) operating the pulse source so that once a critical electron density is reached within the formed plasma, the formed plasma substantially prevents excess pulse energy from directly reaching the material, and so that formed plasma prevents excess pulse energy from substantially increasing the electromagnetic energy ~~deposition~~ depth or the depth and the material removed by ablation;

f) operating the pulse source at a pulse repetition rate greater than approximately 0.1 pulses per second and less than approximately 500,000 pulses per second until a desired depth of material has been removed.

23. The method according to Claim 22 wherein the laser beam defines a spot on the target characterized in that fluence within the beam spot is greater than the threshold fluence for plasma formation.

24. The method of Claim 23, wherein the plasma formation substantially prevents deep energy deposition in the material so that a substantial portion of the

electromagnetic energy deposited in the material is removed with the material ejected.

25. The method of Claim 24, wherein the pulsed electromagnetic energy source produces an output beam having a wavelength in the range of from 10 nanometers to 50 micrometers.

26. The method of Claim 25, wherein each pulse of the pulsed source has an energy in the range of from approximately 0.001 microjoule to approximately 100 Joule, the output beam having a diameter at the material target such that the material experiences an energy fluence in the range from approximately 0.001 to approximately 100 Joule per square centimeter.

27. The method of Claim 26, wherein the pulsed beam exhibits a material removal rate in the range of from approximately 0.01 to approximately 100 micrometers per pulse, the removal rate being substantially constant without regard to material chromophore, material hardness or material state.

28. A method for ablating target material below a surface layer without ablating the surface layer, wherein the target material is substantially transparent to the linear propagation of the electromagnetic pulses comprises focusing the beam below the surface of the target material so that the beam intensity exceeds plasma formation threshold only at approximately the point of focus and the material is substantially removed at that desired point below the surface.

29. A method for a controlled variable rate material removal by a pulsed electromagnetic radiation beam, the interaction between the pulsed electromagnetic radiation beam and the material so that a removal depth is approximately of the same order of magnitude as the energy deposition depth within the target material, and the formation of plasma, the method comprising:

a) providing a source capable of generating an output beam comprised of a sequence of electromagnetic pulses, each electromagnetic pulse having a pulse duration in the range of approximately 1 femtosecond to approximately 10 millisecond;

b) operating the pulse source and manipulating the beam parameters so that the electromagnetic pulses' peak intensity is in the range of approximately 10 W/cm^2 to approximately 10^{16} W/cm^2 and adding to the target material absorption or scattering centers, defects, highly absorbing or highly scattering components, so that the electromagnetic radiation is substantially confined to a volume to be modified.

30. The method of Claim 29 further comprising the step of allowing the electromagnetic energy absorbed by the material to complete the material disintegration and explosive ejection of the targeted material deposition volume, so that a substantial portion of the deposited energy is removed from the target material with the ejected portion of the material.

31. The method of Claim 30 further comprising the step of operating the pulse source at a pulse repetition rate greater than approximately 0.1 pulses per second and smaller than approximately 500,000 pulses per second until a desired depth of material has been removed.

32. The method of Claim 29 wherein plasma is formed and expanded, substantially preventing excess pulse energy from directly reaching the material and so that excess pulse energy does not substantially effect ablation depth.

33. The method of Claim 32, wherein the plasma is allowed to decay such that a layer of the material is removed and substantially most of the electromagnetic radiation pulse energy deposited in the material is removed with the layer.

34. The method of Claim 33, further comprising of operating the pulse source at a pulse repetition rate greater than approximately 0.1 pulses per second and less than approximately 500,000 pulses per second until a desired depth of material has been removed.

35. A method for a controlled, variable rate material modification by a pulsed electromagnetic radiation beam, the interaction between the pulsed electromagnetic radiation beam and the material providing a modification threshold volumetric power density, the method comprising:

a) providing a source capable of generating an output beam comprised of a sequence of electromagnetic pulses, each electronic pulse having a pulse duration in the range of approximately 1 femtosecond to approximately 100 millisecond;

b) operating the pulse source and manipulating the beam parameters so that the deposited volumetric power density within the targeted volume is greater than the threshold power density for material modification, so that control of power density is achieved by varying either one or more of the following parameters: the beam spot size at the targeted location, the duration of the electromagnetic pulsed emissions, the energy of the electromagnetic pulsed emissions, the wavelength of the electromagnetic pulsed emissions, or by spatially and temporally varying the absorption and/or scattering characteristics of the material at the targeted region;

c) allowing interaction energy transients caused by the electromagnetic radiation pulse to substantially decay so that material modification is effected, the material modification include one or more of the following alterations: chemical changes, physical changes, changes to viscoelastic properties,

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changes to optical properties, thermal properties, chemical and physical breakdown, disintegration, ablation melting and vaporization;

d) operating the pulse source at a pulse repetition rate greater than 0.1 pulses per second until a desired volume of the material has been modified.

2 ~~36~~. The method of Claim 1 ~~35~~, wherein the target material is substantially transparent to linear beam propagation and threshold volumetric power density is achieved at a desired target location below the material surface, and within the material volume.

3 ~~37~~. The method of Claim 36, wherein scattering and/or absorption centers, defects, or highly absorbing components, are added to the target material with spatial and/or temporal selectivity to specific, predetermined locations within the target material.

4 ~~38~~. The method of Claim 3 ~~37~~, wherein the pulsed beam exhibits a material modification rate in the range of from approximately 0.01^3 micrometers per pulse to approximately $100{,}000^3$ cubic micrometers per pulse, the modification rate being substantially constant depending substantially on the volumetric power density threshold characteristics of the material and on the target-beam characteristics.

39. A device for ablating a material, the device comprising:

a) an energy radiating device for providing a pulse of energy; and

b) a controller for controlling the energy radiating device, the controller configuring the pulse directed therefrom so as to increase a ratio of the quantity of ~~the~~ material which is ablated thereby with respect to the quantity of the material which is permanently modified thereby;

c) wherein ablating the material with a

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directed energy pulse configured to increase a ratio of the quantity of the material which is ablated thereby with respect to the quantity of the material which is permanently modified thereby minimizes undesirable modification of the material.

40. A device for ablating material with directed energy, the device comprising:

a) a sensor for determining at least one characteristic of the material to be ablated;

b) an energy radiating device for directing a pulse of energy at the material; and

c) a controller for controlling the energy radiating device, the controller configuring the pulse directed therefrom so as to increase a ratio of the quantity of the material which will be ablated thereby with respect to the quantity of the material which will be permanently modified thereby;

d) wherein configuring the pulse directed from the energy radiating device so as to increase a ratio of the quantity of the material which will be ablated thereby with respect to the quantity of the material which will be permanently modified thereby minimizes undesirable permanent modification of the material.

41. The device as recited in Claim 40, wherein the energy radiating device comprises laser radiation.

42. The device as recited in Claim 40 wherein the energy radiation device comprises at least one of a LED, a florescent lamp, and an incandescent lamp.

43. The deice as recited in Claim 40 wherein the energy radiating device comprises a source of incoherent light.

44. A device for ablating a material, the device comprising:

a) an energy radiating device for directing a plurality of pulses of energy at the material, the

pulses having a sufficient pulse rate so as to increase a ratio of the quantity of the material which is ablated thereby with respect to a quantity of the material which is permanently modified thereby; and

b) wherein ablating the material with a plurality of directed energy pulses having a sufficient pulse rate as to increase the quantity of the quantity of the material which is ablated thereby with respect to the quantity of material which is permanently modified thereby minimizes undesirable modification of the material.

45. A device for ablating material with directed energy, the device comprising:

a) a sensor for determining at least one characteristic of the material to be ablated;

b) an energy radiating device for directing a pulse of energy at the material; and

c) a controller for controlling the energy radiating device so as to define a pulse rate of the directed energy which increases a ratio of the quantity of the material which will be ablated thereby with respect to the quantity of the material which will be permanently modified thereby;

d) wherein ablating the material with a plurality of directed energy pulses having a sufficient pulse rate as to increase the ratio of the quantity of the material which will be ablated thereby with respect to the quantity of the material which will be permanently modified thereby minimizes undesirable permanent modification of the material.

46. A product made by a process comprising the steps of:

a) ablating a material by directing a pulse of energy at the material, the pulse being configured to increase a ratio of the quantity of the material which

is ablated thereby with respect to a quantity of the material which is permanently modified thereby; and

b) wherein ablating the material with a directed energy pulse configured to increase a ratio of the quantity of the material which is ablated thereby with respect to the quantity of the material which is permanently modified thereby minimizes undesirable modification of the material.

47. A product made by a process comprising the steps of:

a) ablating a material by directing a plurality of pulses of energy at the material, the pulses having a sufficient pulse rate as to increase a ratio of the quantity of the material which is ablated thereby with respect to the quantity of the material which is permanently modified thereby;

b) wherein ablating the material with a plurality of directed energy pulses having a sufficient pulse rate as to increase a ratio of the quantity of the material which is ablated thereby with respect to the quantity of material which is permanently modified thereby minimizes undesirable modification of the material.

48. A device for material modification and processing, the device comprising:

a) an energy radiating device operative so as to produce a pulsed output beam,

b) a controller for controlling the energy radiating device, the controller configuring the pulse directed therefrom so as to increase a ration of the quantity of the material which is ablated thereby with respect to the quantity of the material which is permanently modified thereby;

c) wherein ablating the material with a directed energy pulse configured to increase ratio of

the material which is ablated thereby with respect to the quantity of the material which is permanently modified thereby;

49. The device of Claim 48, further comprising feedback means for analyzing a material characteristics during the material modification or ablation process.

50. The device of Claim 49 wherein said feedback means further comprises a spectrograph, the feedback means evaluating, a luminescence emission formed by said pulses output beam interaction with said material, feedback means further providing a control signal in response to a change in said luminescence emission whereby said control signal further causes the device controller to change the device operating parameters or to cease operation.

51. The device of Claim 49, wherein said feedback means further comprises of a device for optically evaluating the amount of material removed by each pulse, said material characteristic represented by a depth of material removed, feedback beams further providing a control signal in response to said depth reaching a predetermined value, whereby said control signal further causes the device controller to change the device operating parameters or to cease operation.

52. The device of Claim 49, wherein said feedback means further comprises of a device for evaluating the morphology and/or texture of the material, feedback means further providing a control signal in response to said depth reaching a predetermined value, whereby said control signal further causes the device controller to change the device operating parameters or to cease operation.

53. The device of Claim 49, wherein said feedback means for the comprises of a device for evaluating the target material temperature during the interruption of the beam with the target material, feedback means further providing a control signal in response to said temperature

reaching a predetermined value whereby said control signal further causes the device controller to change the device operating parameters or to cease operation.

54. A device for material modification and processing, the device comprising:

a) an energy radiating device for directing a plurality of pulses of energy at the material, the pulses having a sufficient pulse rate so as to increase a ratio of the quantity of the material which is ablated thereby with respect to quantity of the material which is permanently modified thereby; and

b) a controller for controlling the energy radiating device, the controller configuring the pulse directed therefrom so as to increase a ratio of the quantity of the material which is permanently modified thereby;

c) a means for modifying said energy radiating device output energy wavelength;

d) wherein ablating the material with a plurality of directed energy pulses and with output parameters configured to increase the ratio of the quantity of the material which is ablated thereby with respect to the quantity of the material which is permanently modified thereby minimizes undesirable modification of the material.

5 55. A method for a high precision, highly controllable, variable rate, material removal by a continuously emitting, continuous wave (CW) beam of electromagnetic radiation, the interaction between the electromagnetic radiation, and the material being such that a material removal depth within is approximately equal to an energy deposition depth within the target material, the method comprising the steps of:

a) providing a source capable of generating an output beam comprised of continuously emitted

electromagnetic radiation;

b) redistributing the beam in time and space to form at least one modified beam comprising a plurality of pulses;

c) directing said modified beam(s) so that their energy distribution at any given location on the target material forms a sequence of electromagnetic pulses, each electromagnetic pulse having a pulse duration between approximately 1 femtosecond and approximately 10 millisecond;

d) operating said source and manipulating parameters of the beam so that the electromagnetic pulse's power densities within the region targeted for modification are between approximately 10^4 W/cm^3 and approximately 10^{18} W/cm^3 and are larger ~~than a~~ power density threshold for material ablation;

e) allowing the electromagnetic energy absorbed by the material to complete the material ablation, so that substantially most of the deposited electromagnetic energy is removed from the target material with an ejected portion of the material;

f) repeating said electromagnetic energy absorption, ablation, and energy removal steps at a pulse repetition rage greater than 0.1 pulses per second so that substantially most of the cumulative residual thermal energy left in the material by a pulse train is removed by the commutative ablation, and at a pulse repetition rate less than approximately 100,000 pulses per second until a sufficient depth of material has been removed while mitigating transfer of thermal or mechanical energy into the remaining material and thus mitigating collateral damage thereto.

6 ~~56.~~ The method of Claim 5 ~~55~~ wherein the step of redistributing the beam comprises deflecting sequential

portions of the beam and re-directing them to separate locations so that the net effect at each location is that of a sequence of pulses of a desired duration and a desired pulse repetition rate.

7 ~~57~~. The method of Claim 5 ~~55~~ wherein the step of redistributing the beam comprises directing the beam to a device selected from the group consisting of:

a) a rapidly rotating mirror:

b) a Kerr cell;

c) a Pockels cell;

d) acousto-optic modulator; and

e) electro-optic modulator.

8 ~~58~~. The method of Claim 6 ~~56~~ wherein the switching device sequentially redirects the original beam energy into an optical guiding device selected from the group consisting of;

a) at least one optical fiber; and

b) at least one hollow waveguide light conductor; and

c) at least one optical guiding device such as an articulated arm or an open beam guidance apparatus.

9 ~~59.~~ The method of Claim 8 ~~58~~ further comprising the step of focusing the output of the optical guiding device to a spot size so that power density within the volume targeted for material removal is greater than a threshold power density for material ablation.

10 ~~60~~. The method of Claim 5 ~~55~~ wherein the step of redistributing the beam comprises redirecting the beam into at lest one focusing device and allowing the beam to propagate to separate locations on the target material.

11 ~~61~~. The method of Claim 6 ~~56~~, wherein said pulsed electromagnetic radiation source produces an output beam having a wavelength in the range of from 10 nanometers to 50 micrometers.

12 ~~62~~. The method of Claim 7 ~~57~~, wherein each pulse of

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said continuously emitting beam source has an average power in the range of from approximately 0.0001 Watt to approximately 500 KWatts, and said output beam having a diameter at the target material such that said target material experiences a power per unit area in the range of approximately 1 Watt per square centimeter to approximately 10^{14} Watts per square centimeter.

13 ~~63~~. The method of Claim ~~55~~ 5, wherein said beam is configured to provide a material removal rate in the range of approximately 0.01 micrometers to approximately 10,000 micrometers per pulse, said material removal rate being substantially constant.

14 ~~64~~. The method of Claim ~~56~~ 6, wherein each of the redistributed beams comprise of a sequence of electromagnetic pulses each having a pulse duration in the range of from approximately 1 femtosecond to approximately d0.1 pulses per second and less than approximately 100,000 pulses per second.

15 ~~65~~. The method of Claim ~~56~~ 6 wherein each of the redistributed beams comprise a sequence of electromagnetic pulses and is directed to a target location adjacent one another such that the beams cooperate so as to remove at least some thermal energy generated by preceding pulses in these adjacent beams.

16 ~~66~~. The method of Claim ~~56~~ 6 wherein the step of redistributing the beam further comprises changing the beam wavelength.

67. A device for a high precision, highly controllable, variable rate, material removal by a continuously emitting, continuous wave beam of electromagnetic radiation, the interaction between the electromagnetic beam and the material being such that a material removal depth is approximately equal to an energy deposition depth within the target material, the device comprising:

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a) an energy radiating device for providing continuously emitted electromagnetic energy; and

b) a first controller redistributing the beam into at least one redistributed beam which is redistributed in space and time; and

c) a second controller for redirecting said redistributed beam(s) so that their energy distribution at any given location on the target material forms a sequence of electromagnetic pulses each having a pulse duration in the range of approximately 1 femtosecond to approximately 10 millisecond.

68. The device of Claim 67 wherein the first controller comprises a switching device which deflects sequential portions of the beam and re-directs them to a separate locations to that the net effect at each location is that of a sequence of pulses of specific duration and specific pulse repetition rate.

69. The device of Claim 67 wherein the first controller comprises a switching devices selected from the group consisting of:

a) a rapidly rotating mirror;

b) a Kerr cell;

c) a Pockels cell;

d) acousto-optic modulator; and

e) electro-optic modulator.

70. A method for ablating a material, the method comprising the steps of:

a) directing energy at the material so as to ablate a quantity of the material and so as to permanently modify a quantity of the material, the pulse being configured to increase a ratio of the quantity of the material which is ablated thereby with respect to the quantity of the material which is permanently modified thereby; and

b) monitoring ablative interaction characteristics and identifying ablation events following an interaction between electromagnetic pulses and a target material;

c) wherein ablating the material with an energy pulse configured to increase the ratio of the quantity of the material which is ablated thereby with respect to the quantity of the material which is permanently modified thereby minimizes undesirable permanent modification of the material.

71. The method of Claim 70, wherein said feedback means comprises an electromagnetic radiation detector for detecting the presence of luminescence emission, the feedback means evaluating said luminescence emission caused by each pulse ablative interaction with said material, feedback means further providing a control signal in response to a change in luminescence emission intensity.

72. The method of Claim 71, wherein the feedback means is operatively coupled to the laser, the laser being operatively responsive to said control signal such that the laser either slows down to an interrogative pulse repetition rate or ceases operation upon receipt of the control signal and subsequently increases the interrogative pulse repitition rate when an ablative indicator is restored.

73. The laser system of Claim 70, wherein said feedback means further comprises a spectrograph, the feedback means spectrographically evaluating said plasma formed by each pulse, said material characteristic represented by particular ones of characteristic peaks comprising the plasma spectrum, feedback means further for providing a control signal in response to a change in particular ones of said characteristic peaks intensity.

74. The laser system of Claim 73, wherein the feedback means is operatively coupled to the laser, the

laser being operatively responsive to said control signal such that the laser either ceases operation or slows down to an interrogative pulse repetition rate in response to said controller signal, and subsequently increases when the ablative indicator is restored.

75. The method of Claim 74, wherein ablative interaction is restored by performing at least one adjustment selected from the list consisting of:

a) increasing pulse energy or beam power;

b) decreasing spot size (e.g., optically, or by moving the fiber/HWG/delivery arm etc., closer or further away from the target);

c) decreasing time scale; and

d) changing wavelength to a more absorbing wavelength.

76. The laser system of Claim 70, wherein said feedback means further comprises a spectrograph, the feedback means spectrographically evaluating said luminescence emission formed by each pulse, said material characteristic represented by particular ones of characteristic peaks comprising the plasma spectrum and generated within the ablative interaction, said characteristic peak are absent if ablative interaction did not take place, feedback means further for providing a control signal in response to a change in particular ones of said characteristic peaks intensity.

77. The laser system of Claim 73, wherein the feedback means is operatively coupled to the laser, the laser operatively is responsive to said control signal such that the laser either ceases operation or slows down to an interrogative pulse repetition rate in response to said controller signal, and subsequently increases back when the ablative indicator (luminescence emission) is restored.

78. The method of Claim 70, wherein said feedback means comprises a transducer detector for detecting the

presence of a mechanical recoil momentum, shock waves, thermoelastic stresses or other transient mechanical or thermal effects caused by the ablative interaction of the beam with said material, feedback means further providing a control signal in response to a change in the transducer detector output signal, the laser pulse repetition rate slowing down to an interrogative pulse repetition rate or ceaseing operation and then increases when ablation indicator is restored.

79. A device for ablating a material, the device comprises:

a) a source of electromagnetic energy emitting a quantity of the material and so as to permanently modify a quantity of the material, the pulse being configured to increase a ratio of the quantity of the material which is ablated thereby with respect to the quantity of the material which is permanently modified thereby;

b) feedback means for monitoring ablative interaction characteristics and identifying ablation events following an interaction between electromagnetic pulses and a target material; and

c) wherein the source emits pulsed electromagnetic energy configured to increase the ratio of the quantity of the material which is ablated thereby with respect to the quantity of the material which is permanently modified thereby minimizes undesirable permanent modification of the material.

80. The device of Claim 78, wherein said feedback means comprises an electromagnetic radiation detector for detecting the presence of a luminescence emission, the feedback means evaluating said luminescence emission caused by each pulse ablative interaction with said material, feedback means further for providing a controller with a control signal in response to a change in luminescence

emission intensity.

81. The device of Claim 79, the controller operatively coupled to the laser, the laser operatively is responsive to said control signal such that the laser either ceases operation or slows down to an interrogative pulse repetition rate in response to said controller signal, and subsequently increases when the ablative indicator is restored.